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INTERNATIONAL BULLETIN
OF
BACTERIOLOGICAL NOMENCLATURE
AND
TAXONOMY

Volume 9 October 15, 1959 No. 4

WHY CHRISTEN A SALMONELLA?

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The Enterobacteriaceae Subcommittee of the Nomenclature Committee of the International Association of Microbiological Societies has published the Minutes agreed at its last meeting (1958), in which the concept that the family Enterobacteriaceae should be divided into large groups comparable, but not identical, with genera, and smaller groups down to serotypes, comparable, but not identical, with species and subspecies, needs careful consideration in order to understand the arguments suggested by Kauffmann (1959) in favour of the use of the term "groups" rather than the terms "genus" and "species".

The term "group" is not subject to the rules of nomenclature which govern the use of the terms "genus" and "species"; for this reason many would prefer to use "group", as being less restrictive. It is an ideal term for indicating that members of the group have many similarities. Subsequent research may indicate that they have important differences, and re-grouping will not be affected by the laws of nomenclature. In ordinary life, the situation is similar to the use of the term "boy-friend" and "betrothed" - the former is care-free, the latter is a legal state with defined responsibilities.

Cowan (a, 1959), has pointed out some difficulties in bacterial classification, and the family Enterobacteriaceae is no exception; it was defined in the Report (1958), which stated that the family "is made up of a series of interrelated bacterial types and segregation of these into groups often is difficult because the transition from group to group is gradual, and intermediate forms exist in all instances". During the past few years, new groups have been described and de-

fined. These groups have brought together organisms which were intermediate between groups already described. The grouping has depended on the results of various generally-accepted fermentative and other biochemical tests. At this juncture, the groups may be compared with the genera of a Linnaean Code. The next traditional step in classification within these groups has been the identification of the antigenic complex of each organism. Quite empirically the somatic, the flagellar and some surface antigens have been used to define a particular serotype, but other antigens, such as the mucoid and fimbrial antigens, have not been used for purposes of serotype designation. A number of antigens have been described which, though identical, have been demonstrated in different biochemical groups; for example, the biochemical groups Salmonella, Escherichia and Citrobacter have been defined; within each of these a number of antigens have been described, some of which, although given different symbols, are identical, e.g. Salmonella somatic antigen (O) 35 = Escherichia 0.111. Other Salmonella antigens, such as surface antigen Vi, somatic antigen 6 and flagellar antigen 1,2 may be found in a number of different biochemical groups. Nevertheless, the complete complex of a Salmonella serotype is not found in other biochemical groups; the 9,12:Vi:d of Salmonella typhi is found only in the Salmonella group.

Hybridization between different biochemical groups was first demonstrated by Luria and Burrous (1957) using Shigella, Escherichia and phage. This work has now been extended to include various groups of enterobacteria. Intergroup hybridization does not occur readily, and some characters cannot be transmitted, which suggests that incomplete genetic homology exists between biochemical groups.

Many endeavours have been made to extract the toxic principle of Salmonella and other groups of enterobacteria; the toxic extracts have been tested in a number of ways in a variety of experimental animals, but no differences have been demonstrated in the effect of the toxic substance extracted from S. typhi, S. typhimurium and other members of the family Enterobacteriaceae.

The intergroup relationship is demonstrated by the examples quoted of identity of antigens, results of hybridization, and the toxicity tests.

Within a single biochemical group, such as Salmonella,

it is easy to demonstrate a number of antigens which weave through the group in such a way as to stress the sameness of organisms which may differ in their additional antigens. For example, the 'O' antigen 1 is found in the 0.4, the 0.9, 0.19, and a number of other serological groups, and this antigen may be added to existing complexes by the use of phage (Iseki and Kashiwagi, 1955), and is then found in subsequent generations of the organism. The relation of phage to antigens in Salmonellae of the E serological group has been described earlier by Iseki and Sakai (1953). It is believed that this experimental demonstration of antigen addition, which has also been described in another serological group by Baron et al (1957), indicates that both the giving and receiving organisms are very closely related. Zinder and Lederberg (1952), and Lederberg and Edwards (1953), in their classical papers, demonstrated that phage could effect a change in certain strains of non-motile Salmonellae, such strains becoming motile, the flagellar antigens being the same as those of the motile parent strain when such were available for testing, and both the motility and flagellar antigens were inherited by subsequent generations of the organisms. Similarly, it is possible, by the use of phage, to change at will the flagellar antigens of certain Salmonella strains which are already motile. The phages capable of effecting these changes have been isolated from Salmonellae, will act only on certain Salmonella serological groups and will not act on other biochemical groups, even though they contain Salmonella antigens. These phage-induced changes between Salmonellae occur readily, suggesting genetic homology.

Again, one set of flagellar antigens may be changed to another by the growth of organisms in contact with the appropriate sera. Bruner (1949) changed S. oranienburg, 6, 7:m, t into S. montevideo 6, 7:g, m, s using this technique.

Some strains of Salmonella produced a very mucoid colony, the mucoid material being known as the M antigen of Salmonella. This mucoid colony may be produced by different Salmonella serotypes, such as S. typhimurium, S. paratyphi B, and others, yet this M antigen is the same, irrespective of the Salmonella serotype in which it occurs (Kauffmann, 1954), A mucoid antigen may occur on other Enterobacteriaceae, but the M antigen of Salmonella differs from that of other biochemical groups, such as Escherichia.

from that of other biochemical groups, such as Escherichia.

Fimbriae have been demonstrated in various groups of enterobacteria, such as Escherichia, Shigella and Salmonella, by Duguid and Gillies (1958). Many fimbriate Salmonellae share a major fimbrial antigen, irrespective of the Salmonella serotype, Duguid (personal communication).

In 1956, Kauffmann described the "T1" antigen, a somatic antigen which he had identified in strains of S. paratyphi B, S. typhimurium, and which we have identified in a mutant of a strain of S. senftenberg. These T forms are transient serological forms between smooth (S) and rough (R) forms. The T_1 antigen from these three Salmonella serotypes was identical. Kauffmann (1957) also described the T_2 antigen in S. bareilly, he regards the T_2 antigen as another example of a transient form between S and R.

The biochemical reactions of the Salmonella group are well known, and excluding S. typhi and S. pullorum-gallinarum, are almost identical throughout the 500 serotypes so far described. Of course, minor biochemical variations are encountered between serotypes or between different strains of a single serotype, but these variations are rare in comparison with the typical reactions encountered. The correct position for S. typhi and S. pullorum-gallinarum in the Salmonella or other groups of enterobacteria has led to much controversy at different periods; nevertheless, because of their antigenic and biochemical relationship with other members of the group, I believe it is fair to say that they are now finally accepted as Salmonellae.

DISCUSSION

This account of the various ways in which one Salmonella serotype may be changed to another serotype, the antigens which are identical throughout the whole group, the toxins which are the same irrespective of the particular serotype from which they were derived, and the biochemical reactions, again similar throughout, has been given in order to stress the illogicality of regarding a Salmonella serotype as a species at this time.

The ease with which one serotype may be changed to another by the use of phage or of sera, may be accepted as an example of interfertility which results in a fertile hybrid. In other biological sciences this is regarded as an indica-

tion that the parent types are very similar. In bacteriology, a similar view may be put forward that the serotypes are so similar that they should not be regarded as separate species. Another reason for accepting the Salmonella as a single group is the demonstration of antigens common to all members of very different O groups - the M antigen and the major fimbrial antigens are identical throughout the group, also different strains which are partially degraded have similar antigens - the T_1 or T_2 antigens already described. The only reason, a reason which is unreasonable, for regarding a serotype as a species is the fact that, by tradition, names have been given to Salmonella serotypes, whereas in other groups of enterobacteria, names are not used, the antigenic structure alone being used. I would agree with Cowan (b, 1959) that if change were essential at the present time, then it would be more logical to regard Salmonella, Shigella, etc. as species.

I would suggest that collections of organisms known as Salmonella, Escherichia, and so on, may at some future period require reconsideration, and possibly the true Linnaean concept applied to them. At present the whole subject is undergoing great changes. We are finding out more and more of the relation of one Salmonella to another, of Shigella to Escherichia, and even of what are regarded as very distantly placed groups within the Enterobacteriaceae. At present the Salmonellae are sub-grouped according to the major antigens in their somatic structure; now we know that a single phage can affect somatic antigens 3, 10., 3, 15., and 3, 19: another phage can affect the flagellar antigens of O groups 4, 12 and 9, 12.

The time may come when the facts discussed here, together with other newer findings, may make a re-grouping and a re-naming of these organisms desirable. Because of rapid advances in knowledge, I firmly believe, with Le Minor (1958), that it would be unwise, at this time, to take such a retrograde step as to use the true Linnaean genus-species naming of Salmonellae. Let us keep them as groups, and avoid the chaotic changes of name that have been imposed upon us within the last few years.

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THE TAXONOMIC STUDY OF SARCINA AURANTIACA FLUEGGE

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The seventh edition of Bergey's Manual (1957) includes in the genus Sarcina Goodsir the species S. aurantiaca Flügge, stated to differ from the species S. lutea Schroeter, and S. flava de Bary only by its production of an orange pigment. Flügge's original, concise description (1886) of S. aurantiaca also stresses the production of orange pigment as an important feature. The other characteristics of these three organisms are listed in Bergey's Manual as nearly identical, with some minor differences only. In the present study we have endeavoured to characterize S. aurantiaca adequately and to determine in what respects it differs from the two subspecies of S. lutea.

MATERIALS AND METHODS

Six strains of S. aurantiaca, obtained from the following laboratories, were used: strain 295, Dept. of Biol. Sci., Purdue University, U.S.A; strain 363, Inst. of Fermentation, Osaka, Japan; strain 379, Dept. of Microb., Techn. University, Delft; strain 146, ATCC; strain 836 from J. Evans, Amer. Meat Inst. Found., Chicago; strain 187 was isolated by us from water.

The methods used were those described in our previous work (Kocur and Martinec 1959).

RESULTS

Morphology. All of the strains of Sarcina aurantiaca investigated were Gram-positive and formed characteristic packets of cells on the solid media as well as in the liquid. The size of cells varied from 1.2 - 2μ.

Cultural characteristics. On nutrient agar all strains produced round, slightly raised, convex, opaque, slightly glistening, slightly orange colonies 0.3 to 0.6 cm in diameter. In nutrient broth all the strains deposited a typical sediment, which is also characteristic of the two subspecies of S. lutea. On potato all the strains produced a slight orange pigment, with the exception of strain 363, which produced no pigment at all. Pigment was also produced on fat agar, starch agar, blood agar and other media as well.

Biochemical characteristics. These are listed in Table 1.

DISCUSSION

As indicated above, the morphological and cultural characteristics of the six strains of S. aurantiaca studied were identical, the only exception being that strain 363 produced no pigment on some media, e.g. potato. No importance is attached to this difference for it is a phenomenon common to the pigment-producing bacteria.

With respect to biochemical characteristics, the only differences observed were the failure of strain 367 to liquefy gelatin, the production of slight acidity in sucrose and fructose solutions by strains 836 and 187, and the peptonization of milk by strain 187.

The differences mentioned in the liquefaction of gelatin and in the action on milk are typical for the subspecies of S. lutea, as shown previously (Kocur and Martinec 1959). The differences observed in the action on carbohydrates are not significant, and they agree to some extent with the published data of Krassilnikov (1949).

The results obtained agree completely with the original description of S. aurantiaca (Flügge 1886) and with the data in Krassilnikov's Guide (1949) and Bergey's Manual (1957). Many characteristics of S. aurantiaca were ascertained for the first time in this study, and hence there is at present no basis for comparison of results with those of other authors.

The characteristics of S. aurantiaca and of Sarcina lutea subsp. flava were found to thoroughly identical, the two differing only in the respect that the former produces an orange pigment. Therefore, because pigment production by S. aurantiaca is not constant, being influenced by a great number of factors, it is felt inadvisable to retain S. auran-

Table 1.

Test	No. +	No. -
Gelatin liquefaction	5	1
Nitrate reduction	0	6
Indole	0	6
Hydrogen sulfide	0	6
Milk	1	5
Hemolysis	0	6
Glucose	0	6
Fructose	2	4
Galactose	0	6
Lactose	0	6
Sucrose	2	4
Maltose	0	6
Glycerol	0	6
Mannitol	0	6
Sorbitol	0	6
Dulcitol	0	6
Sodium citrate	0	6
Ammonium citrate	0	6
Acetylmethylcarbinol	0	6
Methyl Red Test	0	6
Starch hydrolysis	0	6
5 % NaCl	6	0
7.5 % NaCl	6	0
10 % NaCl	0	6
Urease	0	6
Catalase	6	0
Lipase	6	0

tiaca as a separate species. Our opinion is confirmed by other authors as well. For example Miller (1952), who studied the variability in pigment production by Sarcina lutea, found that this species when inoculated on fresh nutrient agar, can produce orange or nearly red pigment.

Variability of pigment production is also characteristic for other bacteria, e.g. Serratia marcescens (Reed 1937) and Staphylococcus aureus (Bergey's Manual 1957) among others.

It follows therefore that Sarcina aurantiaca is identical with Sarcina lutea subsp. flava and it is proposed that the former name be regarded as a synonym of the latter.

SUMMARY

Six strains of Sarcina aurantiaca Flügge obtained from various collections.

We have found that Sarcina aurantiaca is identical with Sarcina lutea subsp. flava.

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LETTERS TO THE EDITOR

Dr. F. Kauffmann has proposed in the International Bulletin (9(1): 7. 1959) that the Judicial Commission of the International Committee on Bacteriological Nomenclature issue an Opinion stating:

1. "The species of Enterobacteriaceae are the established serotypes.
2. The genera are groups of related species."

Permission has been given by Dr. Haupt (Giessen) to publish the following letter which he addressed to Dr. Kauffmann and in which he comments on the proposal.

Giessen, am 12. Mai 1959
Frankfurter Str 87

"Herrn
Prof. Dr. F. Kauffmann
Statens Serum Institut

Copenhagen
Dänemark

Betr.: Verhältnis der Taxonomie zur Nomenklatur
Bez.: Kauffmann (1959): Internat. Bull. Bakt. & Taxonomie 9, 1 u. 7
Haupt (1932, 1937): Weichards Ergebn. d. Hyg. usw 13, 672 ff; 17, 198 ff.

Sehr geehrter Herr Kollege!

Die von Ihnen erwähnte Aufteilung der Gattung Salmonella nach den O-Gruppen habe ich in den beiden obigen Arbeiten durch die Bildung von Sektionen ("Asalmonia", "Besalmonia" etc) vorgenommen.

Abgesehen davon, dass Empfehlungen des "Code" keine bindende Kraft besitzen, ist die Taxonomie als Wissenschaft völlig frei. Es bestehen keine Vorschriften in der Hinsicht, dass dieser Teil der Wissenschaft beschränkt werden kann. Wenn Sie als Taxonomist serologische Unterschiede als ausreichend für die Trennung von Arten betrachen, so

kann niemand dagegen Einspruch ergeben. Jeder andere Autor kann jedoch anderer Ansicht als Sie sein.

Andrerseits ist die Nomenclatur an die Regeln des Code gebunden, also nicht frei! Es ist keine Seltenheit, dass es nicht leicht ist, taxonomische Erkenntnisse nomenklatorisch auszuwerten. Es gibt bei keiner der 3 Nomenklaturregeln für die belebte Welt die Möglichkeit, eine Art durch Anführung von Zahlen und Buchstaben hinter dem Gattungsnamen regelrecht zu benennen.

Mit Ihren beiden Mitteilungen haben Sie sicherlich eine sehr bedeutsame Frage aufgeworfen. Ob Sie allerdings durch ein Richterkollegium geklärt werden kann, erscheint mir fraglich. Mehrheitsbeschlüsse gelten in der Wissenschaft nicht viel.

Um nicht missverstanden zu werden, die epidemiologische Bedeutung der Aufsplitterung der Gattung Salmonella ist unbestritten; aus Gründen der Übersichtlichkeit, tut eine Konzentration auf Gruppen ober halb der „Art" bitter not.

Mit dem Ausdruck der vorzüglichsten Hochachtung
ergebenst

(gez. Haupt)"

THE PLURAL OF THE BACTERIAL GENERIC NAME LEUCONOSTOC

The following inquiry has been received: "What is the plural of the generic name Leuconostoc?"

The generic name Leuconostoc is a neologism (a coined word) treated as a modern Latin neuter noun, with the meaning "colorless Nostoc".

1. The declension of Leuconostoc is governed by that of Nostoc, the name of an algal genus.

2. Nostoc is neither classical Latin or Greek, but a word found in mediaeval Latin. It was applied by Vaucher (1803) to a genus of blue-green algae (Myxophyceae).

3. The etymology of Nostoc is obscure. DeToni (Sylloge Algarum 5:386) states that the stem is Nostoch-, according to Lyngbe origin unknown, apparently from Paracelsus and alchemy. However deToni suggests that it may be related

to the Greek nostos (νόστος), a return homeward with the meaning of the Latin reversio (a turning back, reversion) referring to the swelling of little plants (such as Noctoc) after a rain.

4. Nominative singular Nostoc, genitive singular Nostochis, nominative plural Nostocha.

This stem has been used in the literature of phycology in the formation of names of suprageneric taxa, as in Nostochaceae and Nostochineae.

5. Accordingly the stem of Leuconostoc is Leuconostoch-. Nominative singular Leuconostoc. Genitive singular Leuconostochis. Nominative plural Leuconostocha. Genitive plural Leuconostochum. If a family name were based upon Leuconostoc, it would be Leuconostochaceae.

6. If used in the vernacular, obviously in English the plural of leuconostoc is leuconostocs.

NEWS AND NOTES

Liaison between Subcommittees on Taxonomy and the International Committee on Bacteriological Nomenclature. Each of the taxonomic subcommittees recognized by the International Committee has as an ex officio member one or other of the two Permanent Secretaries. The published lists of members of these subcommittees have not in all cases included the names of the ex officio members designated to maintain liaison with the International Committee. Dr. Cowan states the following assignments are current.

Taxonomic Subcommittee on	Ex officio member
Actinomycetales	W.A. Clark
Brucella	W.A. Clark
Clostridium	S.T. Cowan
Enterobacteriaceae	S.T. Cowan
Leptospira	S.T. Cowan
Medical Mycology	S.T. Cowan
Mycobacterium	W.A. Clark
Staphylococcus phage typing	S.T. Cowan
Streptococcus	W.A. Clark

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SUBCOMMITTEE ON TAXONOMY OF THE ACTINOMYCETES

The participants of the Round Table on the Taxonomy of the Actinomycetes held during the VII International Microbiological Congress in Stockholm in August, 1958, decided to form a permanent committee. It was unanimously agreed that recognition as a Subcommittee on the Taxonomy of the Actinomycetes of the International Committee on Bacteriological Nomenclature be requested. Recognition has been granted under the rules of the International Committee.

The Subcommittee has stated as its aims the following:

1. To promote studies on the Taxonomy of the Actinomycetes by:
   a) Facilitating the exchange of information among investigators of these organisms.
   b) Encouraging cooperative studies of these microbes.
   c) Helping initiate and maintain an international type culture collection.
2. To establish uniformity wherever possible in the formation of taxa and in nomenclature.

The membership of the Subcommittee is as follows:

Gottlieb, Prof. Dr. D. (Chairman), Dept. Plant Pathology, Univ. of Illinois, Urbana, Illinois, U.S.A.

Küster, Dr. E. (Secretary), (Inst. Biochemie d. Bodens, Forsch. Anst. Landw. Braunschweig-Volkenrod, Bundesalle 50, Braunschweig, Germany) Present address: Department of Industrial Microbiology, University College, Ardmore House, Stillorgan Road, Dublin, Ireland.

Baldacci, Prof. Dr. E., Inst. Patol. Vegetale Univ. Milano, Via Celoria 2, Milano, Italy.

Ciferri, Prof. Dr. R., Inst. Botan. Univ. Pavia, P.O. Box 165, Pavia, Italy.

Ettlinger, Prof. Dr. L., Inst. f. landw. Mikrobiologie and Gärungsbiologie, Zurich, Switzerland.

Krasil'nikov, Prof. Dr. N.A., Inst. Microbiol., Acad. Sci., U.S.S.R., Lenin Avenue 33, Moscow, U.S.S.R.

Okami, Dr. Y., Natural Institute of Health, Minato-Ku, Tokyo, Japan.

Pridham, Dr. T.G., Northern Utiliz. Res. Branch. U.S. Dept. Agric., Peoria, Illinois, U.S.A.

Sanchez-Marroquin, Dr. A., Miami 40, Mexico City D.F., Mexico.
Waksman, Prof. Dr. S.A., Inst. Microbiol., Rutgers Univ., New Brunswick, New Jersey, U.S.A.

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NEW SUBCOMMITTEE ON BRUCELLA

Pursuant to a request from the World Health Organization the International Committee on Bacteriological Nomenclature of the International Association of Microbiological Societies has organized an expert taxonomic subcommittee on the genus Brucella.[1] The following were invited to become members and have accepted.

Dr. A. W. Stableforth (Chairman), Central Veterinary Laboratory, Ministry of Agriculture, Fisheries and Food, New Haw, Weybridge, Surrey, England.

Dr. Lois Jones (Secretary), The University of Wisconsin, College of Agriculture, Madison 6, Wisconsin, U. S. A.

Dr. R. D. Housewright, Fort Detrick, Frederick, Maryland, U. S. A.

Dr. M. M. Kaplan, World Health Organization, Palais des Nations, Geneva, Switzerland.

Dr. N. B. McCullough, National Microbiological Institute, Bethesda, Maryland, U. S. A.

Dr. K. F. Meyer (Director), University of California, The George Williams Hooper Foundation, The Medical Center, San Francisco 22, California, U. S. A.

Dr. G. Renoux, Institut Pasteur de Tunis, Tunis, Tunisia.

Dr. G. C. Van Drimmelen, Department of Agriculture, Division of Veterinary Services, P. O. Onderstepoort, South Africa.

Dr. P. A. Vereshilova (Director), Experimental Brucellosis Laboratory, "Gamaliya" Institute of Epidemiology and Microbiology, Academy of Medical Sciences of the U. S. S. R., Shukinskaye ul. 33, Moscow D-183, U. S. S. R.

Dr. G. S. Wilson, Director of Public Health, Laboratory Service, 38 Old Queen Street, Westminster, London, S. W. 1, England.

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[1] See Minute 11, Intl. Bull. 8:148. 1958.

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A COMPARISON OF THE SHIGELLA CLASSIFICATION USED IN THE U.S.S.R. WITH THE INTERNATIONAL SHIGELLA SCHEMA

W.H. Ewing, Jane G. Johnson and Betty R. Davis

International Shigella Center (Atlanta)
Communicable Disease Center,
Public Health Service, U.S. Department
of Health, Education, and Welfare,
Atlanta, Georgia

Since translations of many of the Russian scientific journals now are available and since there are many articles on Shigella and on bacillary dysentery in these journals, it seemed desirable to compare the Shigella nomenclature in use in Russia with the International system of Shigella taxonomy and nomenclature, which is in general use in most other parts of the world. Accordingly, cultures representative of the various Shigella serotypes found in Russia were requested for this purpose and in due course 18 Shigella strains were received from Prof. H.D. Ravich-Birger and E. Elchinova of the Tarassevich State Control Institute, Moscow. Information that accompanied the cultures indicated that they were designated according to the classification adopted in the Soviet Union and that the cultures were representative of the Shigella serotypes found there. The writers are indebted to Prof. Ravich-Birger and co-workers for the courtesy of complying with our request for cultures and for supplying the accompanying information. Similar requests addressed to several other investigators in the U.S.S.R. were not acknowledged.

Cultures of Shigella dysenteriae 1, S. dysenteriae 2, and Shigella sonnei were not included in the shipment of 18 strains. However, it is known that these serotypes occur in the Soviet Union and that the three above-mentioned names and serotype designations are synonymous with Grigorjev-Shiga, Stutzer-Schmitz, and S. sonnei, respectively. The names Shigella shigae (S. dysenteriae 1) and Shigella schmitzii (S. dysenteriae 2) also occur in papers emanating from Russia (e.g. Sirotinin, et al. 1958).

Cultures of S. dysenteriae 7, 8, 9, and 10, Shigella flexneri 1a, 3b, 4a, 4b, and 5, Shigella boydii 3, 6, 8, 10,

11, 13, 14, and 15 were not included in the shipment sent at our request. Hence, it was concluded that these Shigella serotypes probably have not been recognized in the Soviet Union.

The identification of the 18 Shigella cultures as determined in this laboratory is given in table 1, along with the names, numbers, and other designations used in the Russian classification, and an analogy to the International Classification as determined in Russia. Attention may be directed to the fact that there are several discrepancies in serotype determinations as made in Russia and as given in the analogy. For example, culture 10428, (B. dysenteriae, Nowgorodskaja-Semenova, "Roman") was said to be analogous to S. dysenteriae 4 in the International system. In our hands culture 10428 proved to be S. dysenteriae 3. Similarly, strain 2291 (B. dysenteriae, Nowgorodskaja, 1618) was identified as S. dysenteriae 3, but proved to be S. dysenteriae 4. Also, culture 326 (Flexner f) proved to be S. flexneri 1b rather than 1a and strain 1964 (Flexner b) was identified here as S. flexneri 2b not as an X variant of S. flexneri.

It may be noted (table 1) that according to the information received with the strains from Russia there are no analogous serotypes in the International system of classification for the Russian types Flexner d, and Flexner Boyd-Nowgororskaja II, IV, and VI. However, these serotypes were typed in this laboratory as S. flexneri 3c and S. boydii 7, 9, and 12, respectively (table 1).

Culture 10931, called the Newcastle subspecies of Flexner, was identified here as the Boyd 88 biotype of S. flexneri 6 rather than the Newcastle biotype. Judging from the available literature on the subject the true Newcastle biotype apparently is uncommon in most parts of the world.

SUMMARY

A comparison of the Shigella serotype designations used in much of the literature emenating from the Soviet Union with those employed in the International Shigella Schema is presented for use by investigators who are interested in the Russian reports on shigellae and bacillary dysentery.

REFERENCE

Sirotinin, N.N. et al. 1958. J. Microbiol., Epidemiol., Immunobiol., 29:346. (Pergamon Institute translation).

Table 1. Identification of Representative Shigella Cultures from Russia

Culture No. (Orig.)	Classification according to International system as determined at International Shigella Center, Atlanta		Russian classification (which accompanied the cultures) Species	Subspecies	Serotype	Analogy to International classification as determined in Russia (Information accompanied cultures)	
	Subgroup A						
*	S. dysenteriae	1	Grigorjev-Shiga				
*		2	Stutzer-Schmitz				
10428		3	Bact. dysenteriae	Nowgorodskaja-Semenova	"Roman"	S. dysenteriae	4
2291		4	do.	do.	1618	do.	3
1676		5	do.	do.	819	do.	5
4187		6	do.	do.	"Tjacht"	do.	6
*		7					
*		8					
*		9					
*		10					
	Subgroup B	Formula**					
*	S. flexneri	1a I:3, 4(7, 8)					
326		1b I:(3, 4), 6	Flexner	Flexner	f	S. flexneri	1a
538		2a II:3, 4	do.	do.	c	do.	2a
1964		2b II:7, 8	do.	do.	b	do.	var. "X"
224		3a III:6, 7, 8	do.	do.	e	do.	3

1964		2b	II:7, 8	do.	do.	b	do.	var. "X"
224		3a	III:6, 7, 8	do.	do.	e	do.	3
*		3b	III:(3, 4), 6, 7, 8					
414		3c	III:(3, 4), 6	do.	do.	d	No analogous serotype	
*		4a	IV:3, 4					
*		4b	IV:(3, 4), 6					
*		5	V:7					
10931		6	VI:(3, 4)	do.	Newcastle	-	S. flexneri 6	
266	Y variant		-:3, 4	do.	Flexner	a	do.	var. "Y"
*	X variant		-:7, 8					
	Subgroup C							
30	S. boydii	1		Flexner	Boyd-Nowgorodskaja	I	S. boydii 1	
2012		2		do.	do.	V		2
*		3						
1946		4		do.	do.	III		3
159		5		do.	do.	VII		5
*		6						
4830		7		do.	do.	II	No analogous serotype	
*		8						
12181		9		do.	do.	IV	No analogous serotype	
*		10						
*		11						
2469		12		do.	do.	VI	No analogous serotype	
*		13						
*		14						
*		15						
	Subgroup D							
*	S. sonnei			Sonnei				

* Cultures of these serotypes were not received (see text).
** Abbreviated antigenic formula.

INTERNATIONAL BULLETIN OF BACTERIOLOGICAL NOMENCLATURE AND TAXONOMY
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REQUEST THAT THE NAME OF A GENUS OF BACTERIA BE RECOGNIZED AS NOT VALIDLY PUBLISHED IF ITS CHARACTERIZATION WAS BASED UPON IMPURE OR MIXED CULTURES

Editorial Board

The Board of Editors of Index Bergeyana has requested that the Judicial Commission issue an Opinion defining the nomenclatural status of a new bacterial generic name proposed by an author for a genus of bacteria in which the one or more species included in each genus are known to be based upon mixtures of organisms or impure (mixed) cultures. Rule 24g of the Bacteriological Code states that the name of a taxon is illegitimate if based upon an impure or mixed culture. However, illegitimate names may have been validly published and must be considered in bacteriological nomenclature (as in homonymy). Such consideration has led to some confusion in nomenclature. The confusion can be avoided by an Opinion to the effect that such names are to be considered as not validly published.

An example of confusion may be cited: Bokor (1930, 22) isolated and described what he believed to be a pure culture of Spirochaeta cytophaga Hutchinson and Clayton (1919, 150), concluding that the culture should not be included in the genus Spirochaeta Ehrenberg (1835, 313) but should be placed in a new genus, which he named Mycococcus. Stanier (1940, 620), on the other hand, concluded that the culture studied by Bokor was a mixed culture of Spirochaeta cytophaga and an actinomycete. Acceptance of Stanier's conclusion would render the generic name Mycococcus Bokor illegitimate (Rule 24g) but not invalidly published. Krassilnikov (1938, 349) rejected Mycococcus Bokor and then independently proposed Mycococcus as the name of a new genus of actinomycetes to include five new species. Mycococcus Krassilnikov was recognized by Nellis (1957, 707), who designated Mycococcus albus Krassilnikov (1938, 350) as the type species. Mycococcus Krassilnikov is a later homonym of Mycococcus Bokor and, according to Rule 24d of the Bacteriological Code, must be rejected even if the earlier homonym is illegitimate. Therefore the legitimacy of the generic name Mycococcus Krassilnikov is contingent upon whether or not the earlier homonym, Mycococcus Bokor, was validly published.

Draft of a Proposed Opinion

Opinion ---. The name of a genus of bacteria is not validly published if the characterization of the genus when initially proposed was based upon impure or mixed cultures. Such generic name shall have no nomenclatural standing in bacteriology.

References

Bokor, Rudolf. 1930. Mycococcus cytophagus n. sp. 1929. (Spirochaeta cytophaga Hutchinson and Clayton 1919). Untersuchungen über aerobe, bakterielle Cellulosezersetzung mit besonderer Berücksichtigung des Waldbodens. Archiv für Mikrobiologie 1:1-34.

Ehrenberg, C.G. 1883. Dritter Beitrag zur Erkenntniss grosser Organisation in der Richtung des kleinsten Raumes. Physik. Abhandl. d. Königl. Akad. d. Wissensch. zu Berlin (aus dem Jahre 1833). pp. 145-336.

Hutchinson, Henry Brougham and James Clayton. 1919. On the Decomposition of Cellulose by an Aerobic Organism (Spirochaeta cytophaga, n. sp.). Jour. Agr. Sci. 9:143-173.

Krassilnikov, N.A. 1938. A new Genus of "Actinomycetales" - Mycococcus n. gen. Mikrobiologiia. 7(Part 1): 335-352.

Nellis, Lois. 1957. Genus Mycococcus Krassilnikov, in Breed et al., Bergey's Manual of Determinative Bacteriology, The Williams and Wilkins Co., Baltimore. 7th ed. pp. 707-713.

Stanier, R.Y. 1940. Studies on the Cytophagas. Jour. Bact. 40:619-635.

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Volume 9 No. 4 October 15, 1959 pp. 185-194

REQUEST FOR AN OPINION RELATIVE TO NOMENCLATURAL STANDING AND ACCEPTANCE OF CERTAIN PUBLICATIONS OF TRÉCUL, HALLIER, BILLROTH AND OGSTON

Preliminary Statement

Editorial Board

A request has been received from the editors of the Index Bergeyana asking that the Judicial Commission of the International Committee on Bacteriological Nomenclature place certain publications issued in the earlier history of bacteriology in the list of Rejected Publications, i.e., publications in which names of taxa proposed or used are to be regarded as not validly published and as having no standing in bacteriological nomenclature. Authority for such action is found in paragraph 8 listing the Functions of the Judicial Commission (International Code of Nomenclature of the Bacteria and Viruses, 1958, p. 133). This directive authorizes the Judicial Commission

> "To prepare and publish a list of publications in the field of bacteriology in which the names proposed shall be regarded as not validly published and having no standing in bacteriological nomenclature."

The request recommends that certain publications of four authors (Trécul, Hallier, Billroth and Ogston) be included in the List of Publications Rejected for Nomenclatural Citation. The names proposed or used therein shall have no standing in bacteriological nomenclature.

The request emphasizes that the names proposed by these authors do not meet the requirements of any nomenclatural code: they were in some cases used as convenient designations of the several growth forms of an organism assumed to have a pleomorphic growth cycle; in some cases they were not identified as names of bacteria; in many cases they were based upon mixtures of quite unrelated organisms (impure cultures). In many cases these names have been proposed as generic names by later authors; in some of these cases there arises confusion due to the citation of the authors of names not validly published or illegitimate. The reasons for the request are here reviewed.

1) Trécul, A. 1865. Production de plantules amylifères dans les cellules végétales pendant la putréfaction. Cholorphylle cristallisée. Compt. rend. Acad. Sci., Paris. 61:432-436.

Trécul, in a study of the milky latex of various plants. (Apocynum, Asclepias, Ficus and others), noted the presence of granules which in some cases stained yellow upon addition of iodine, in some cases stained blue as does starch. He also observed similar bodies within the cells of putrefying plant tissues and noted their resemblance to bacteria. His statement is as follows:

"Malgré la variété des formes de ces petits végétaux, ou plutot à cause de cette variété même puisque l'on passe d'une forme à l'autre par toutes les gradations; en raison aussi de l'amidon qu'ils contiennent, et pour rappeler la ressemblance des formes cylindroïdes avec les Bactéries, je crois utile de les réunir sous le nom d' Amylobacter. Si on voulait les diviser d'après les formes les plur dispartes, on pourrait établir trois sous-genres: 1° l'Urocephalum, qui comprendrait les formes en têtard; 2° l'Amylobacter vrai, auguel seraient attribuées les formes cylindracées; 3° l'Clostridium qui renfermerait les formes en fuseau."

In discussing these "petits vegetaux", Trécul did not definitely place them with the bacteria. Later authors have generally agreed that he observed certain of the butyric acid bacteria which contain granules that stain blue with iodine. All the forms seen were included in the general term Amylobacter (starch rod) with three "subgenera": Urocephalum for the "tadpole" forms, Amylobacter for the rod forms, and Clostridium for those that were spindle-shaped (fusiform).

The use of the three "subgeneric" names of Trécul by later authors should be noted.

Amylobacter was proposed as a generic name by Duclaux (1895, p. 813), who named and described two species, Amylobacter butylicus and A. ethylicus. Other authors have accepted the generic names, as in Amylobacter navicula Wehmer (1898, p. 696), Amylobacter non-liquefaciens

Ruschmann and Bavendam (1925, p. 359), and Amylobacter butylicum Beynum and Pette (1935, p. 200). Amylobacter has also been used as a specific epithet, as in Bacillus amylobacter van Tieghem (1877, p. 345) and Metallacter amylobacter Trevisan (1879, p. 147). Enlows (1920, 14). in her critique of bacterial generic names, cites Amylobacter Trecul. Amylobacter Trécul has been listed as a synonym of Clostridium by deToni and Trevisan (1889, p. 1002), by Spray (1939, p. 793 in Bergey's Manual of Determinative Bacteriology, ed. 5) and by Krasil'nikov (1949, p. 648). Amylobacter was rejected an an illegitimate name by Erwin F. Smith (1905, p. 174).

Clostridium was proposed as a generic name by Prazmowski (1880, p. 23) in the following statement:

> "Um die Synonomik der Bacterien nicht mit einem neuen Worte zu bereichern, habe ich den von Trécul für eine Habitusform des Buttersaüreferments zuerst angewendeten Nomen Clostridium zur Bezeichnung meiner Gattung gewählt."

Prazmowski evidently considered Trécul as having named an environmental form (Habitusform), not as having proposed a bacterial generic name. He named and described two species: C. butyricum and C. polymyxa. The genus Clostridium (type species C. butyricum) is commonly accepted. Clostridium Trécul may be regarded as a nomen nudum, Prazmowski and not Trécul should be cited as the author.

Urocephalum, Trécul's third subgenus, has apparently never been used as a generic or subgeneric name in bacteriology. Enlows (1920, p. 96) cites Urocephalum Trécul in her critique of bacterial generic names. Urocephalum Trécul has been listed as a synonym of Clostridium by Migula (1900, p. 536). Several authors have used urocephalum as a specific epithet, as in Tyrothrix urocephalum Duclaux (1882, p. 23 and Bacillus urocephalum (Duclaux) Migula (1900, 588).

The request to reject this publication is based on the fact that the author did not place the forms he described in the bacteria and that the names given these forms are not names of bacteria.

Approval of the request would eliminate confusion with

reference to citation of later bacterial names adapted from the "subgenera" of Trécul.

2) Hallier, Ernst. 1866. Die pflanzlichen Parasiten des menschlichen Körpers für Aerzte Botaniker und Studierende zugleich als Einleitung in das Studium der niederen Organismen. Leipzig.

Hallier, E. 1868. Mikroskopische Untersuchungen. Zwei neue Untersuchungen über den Micrococcus. Flora N.S. 26:54-57.

Hallier, E. 1868. Mykologische Untersuchungen. III. Untersuchungen der Parasiten beim Tripper, beim weichen Schanker, bei der Syphilis und bei der Rotzkrankheit der Pferde. Flora N.S. 26:289-301.

Hallier, Ernst. 1870. Die Parasiten der Infectionskrankheiten. Zeitschr. f. Parasitenkunde. 2:113-132.

Hallier introduced the theory of pleomorphism as applied to microorganisms and particularly to the bacteria. He held that a bacterial species exhibited many growth forms, sometimes having the morphology of a bacterium, sometimes of a mold. His publication led to much speculation as to what constituted a bacterial species. He gave names to some of the growth forms he observed. For example he terms a spherical growth form of an organism a micrococcus. He did not employ such names in a generic sense.

Hallier (1870) described what he believed to be the cause of farcy (glanders) in the horse. He named the culture Malleomyces equestris and gave in detail a description of the parasite. He emphasized its extreme pleomorphism, noting that it took on the form of bacteria and of various molds. Study of Hallier's descriptions and illustrations adequately demonstrate that he was working with impure or mixed cultures. He used a combined generic-species description. A name given to an organism evidently in mixed culture (under Rule 24g of the Bacteriological Code) is illegitimate. However, the requirements of valid publication for the generic name and for the binary combination were met.

Malleomyces has been used by several later authors as a generic name.

Pribram (1933, 11) accepted Hallier's Malleomyces and designated the type species as Malleomyces mallei. Breed (1948, p. 544) recognized the genus as Malleomyces Pribram and M. mallei (Zopf) Pribram as the type species.

Neither the genus Malleomyces Hallier nor the species M. equestris are legitimate because the descriptions are based upon impure or mixed cultures. The request proposes that the publications in which these names were issued by Hallier be rejected and that the names given be regarded as without standing in bacteriological nomenclature.

3) Billroth, C. A. T. 1874. Untersuchungen über die Vegetationsformen von Coccobacteria septica. Berlin.

Billroth extended Hallier's concept of bacterial pleomorphism by proposing that all bacteria be considered as included in one very pleomorphic species which he named Coccobacteria septica. He described his species as consisting in part of spherical and in part of rod-shaped cells. One form could change into the other, though there was a marked tendency for cells of each morphology to perpetuate themselves. Billroth gave names to the many growth forms of the species. Among these were Streptococcos for spherical cells occurring in chains, Petalococcos and Petalobacteria for cells with gelatinous capsules producing cell plates. Gliacoccos for spherical cells in a mass, Ascococcos for spherical cells within a common capsule and Streptobacteria for rods occurring in chains. Other names applied included Micrococcos, Mesococcos, Megacoccos, Microbacteria, Mesobacteria, Megabacteria, Monococcos, Monobacteria, Ascobacteria, Coccos, Diplobacteria, Diplococcos, Gliobacteria, Helobacteria, Leptothrix, Micrococcoglia, Sarcinacoccos and Siphonomyxa.

These terms were not proposed as generic names, but many have since been proposed or used as generic names, in some cases with citation of Billroth as author of the generic name. Among the names used by Billroth for growth forms and later by other authors, usually as names of genera, are the following (frequently with modified endings):

Ascobacteria van Tieghem (1880, p. 151) with species A. ulvina van Tieghem.

Ascococcus Cohn (1785, p. 154), species A. billrothii Cohn.

Coccobacteria Schroeter (1886, p. 143) as the name of the fourth order of bacteria.

Diplococcus Weichselbaum (1886, p. 506), species D. pneumoniae Weichselbaum.

Gliacoccus Maggi (1886, p. 82) named G. aceti as a variety of his Micrococcus aceti.

Megacoccus Maggi (1886, p. 83) used the combination Micrococcus (Megacoccus) butyricus for the fermentum butyricum of Fitz.

Microbacterium Orla-Jensen (1919, p. 179) with several species.

Micrococcus Cohn (1872, p. 151) with several species.

Petalococcus aceti var. duclauxi was named by Maggi (1886) as a variety of Micrococcus aceti.

Streptobacterium Jacqué and Masay (1912, p. 180) with species S. foetidum.

Streptobacter Schroeter (1886, p. 157), proposed as the name of a subgenus to include seven species of Bacillus.

Streptococcus Rosenbach (1884, p. 22) with two species.

The request to reject the publication of Billroth is based on the fact that the terms used by him for growth forms described were not proposed as generic names and therefore have no standing in bacteriological nomenclature.

4) Ogston, Alex. 1882. Micrococcus poisoning. Journ. Anat. and Physiol. 16:526-567.

Ogston, Alex. 1883. Micrococcus poisoning (con't). Journ. Anat. and Physiol. 17:24-58.

Ogston concluded that pus production in general was the result of the presence and growth of spherical bacteria; he regarded such infections as sapremia, septicaemia, pyaemia, phlegmon, etc., as being produced by "micrococcus poisoning". He was able regularly to demonstrate the presence of cocci by microscopic methods. He noted the presence of both chains of cells and cell groups. He (1883, p. 27) described them as follows:

"Micrococcus is met with in two distinct forms, chains and groups. They are often found together, yet the two are different, and the chain form does not pass into the groups form, nor the groups form into the chain form. Throughout this paper the term micrococcus is used as embracing both forms; the chain coccus is often called streptococcus (Billroth), and I shall call the grouped form staphylococcus (from σταφυλή, a bunch of grapes)."

Ogston evidently did not regard the organisms which he termed micrococcus, streptococcus and staphylococcus, as growth forms, in the sense of Billroth, nor did he propose them as names of genera, nor did he propose any binary combination.

All three of the names proposed, two of them (micrococcus and streptococcus) following Billroth and one (staphylococcus) new, were adopted by later authors as names of bacterial genera sometimes with citation of Ogston as the author.

The request proposes that the cited publications by Ogston be placed in the list of Publications Rejected for use in bacteriological nomenclature, because the names used by Ogston were not intended as generic names.

Draft Statement of Proposed Opinion

Rejection of Certain Publications of Trécul, Hallier, Billroth and Ogston as Having no Nomenclatural Standing in Bacteriology

1. The species, subgeneric, generic or other names proposed in the several publications listed below were not validly published as names of taxa of bacteria and have no standing in bacteriological nomenclature. These publications are included in the list of Rejected Publications as authorized in paragraph 8 under "Functions of the Judicial Commission", in Section IV of the International Code of Nomenclature of the Bacteria and Viruses:

a). Trécul, A. 1865. Production de plantules amylifères dans les cellules végétales pendant la putréfaction. Chlorophylle cristallisée. Compt. rend. Acad. Sci., Paris. 61:432-436.

b_1). Hallier, Ernst. 1866. Die pflanzlichen Parasiten des menschlichen Körpers für Aerzte, Botaniker und Studierende zugleich als Einleitung in das Studium der niederen Organismen. Leipzig.

b_2). Hallier, Ernst. 1868. Mikroskopische Untersuchungen. Zwei neue Untersuchungen über den Micrococcus. Flora N.S. 26:654-657.

b_3). Hallier, E. 1868. Mykologische Untersuchungen. III. Untersuchungen der Parasiten beim Tripper, beim weichen Schanker, bei der Syphilis und bei der Rotzkrankheit der Pferde. Flora N.S. 26:289-301.

b_4). Hallier, Ernst. 1870. Die Parasiten der Infectionskrankheiten. Zeitschr. f. Parasitenkunde 2:113-132.

c). Billroth, C.A.T. 1874. Untersuchungen über die Vegetationsformen von Coccobacteria septica. Berlin.

d_1). Ogston, Alex. 1882. Micrococcus poisoning. Journ. Anat. and Physiol. 16:526-567.

d_2). Ogston, Alex. 1883. Micrococcus poisoning (con't). Journ. Anat. and Physiol. 17:24-58.

2. Names proposed in the above listed publications of Trécul, Hallier, Billroth and Ogston have in some cases been adopted by later authors as the names of bacterial taxa and one or other of the four authors named cited as author. In such cases the name of the taxon is to be ascribed to the first subsequent author whose publication meets the requirements of valid publication as prescribed in the International Code of Bacteria and Viruses (Rule 11).

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